IS 11207 (1983): Helmets for Mountaineers [PGD 27: Mountaineering Equipment]

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(Reaffirmed 2001)

Indian Standard

SPECIFICATION FOR HELMETS FOR MOUNTAINEERS

[Ref : Doc : EDC 76 (3443)]
Mountaineering Equipment Sectional Committee, EDC 76; Mountaineering Equipment Subcommittee, EDC 76 : 1

1. Scope — This standard covers requirements for helmets for wear by those climbing mountains in order to protect the skull from injury by blows on the head resulting from falling stones or impacts during a fall.

2. Terminology — For the purpose of this standard, the following definitions shall apply.

2.1 *Protective Helmet* — Headwear primarily intended to protect against a blow to the wearer's head.

2.2 *Shell* — The hard, smoothly finished material that provides the general outer form of helmet.

2.3 *Protective Padding* — Material provided to absorb impact energy which in addition provides for thermal insulation.

2.4 *Retention System* — The complete assembly by means of which the helmet is maintained in position on the head, which includes headband, chin strap and cradle.

2.4.1 *Headband* — Part of retention system surrounding the head. The plane of lower margin of headband shall correspond to reference line of the headform (*see* IS : 7692-1975 Wooden headforms for testing of helmets).

2.4.2 *Anti-concussion tapes* — Supporting straps which form the cardle along with the drawlace and in addition absorb impact energy.

2.4.3 *Chin strap* — Strap that passes under the wearer's chin to keep the helmet in position.

2.4.4 *Cradle* — The adjustable assembly comprising anti-concussion tapes and drawlace, intended for affording adequate clearance for ventilation and to ensure proper fitment. This also in addition absorbs impact energy.

2.5 *Peak* — A detachable extension to the shell above the eyes.

2.6 *Drawlace* — The cord used in the cradle to regulate the fitting of the helmet.

2.7 *Chin Cup* — The device that fits around the point of wearer's lower jaw.

3. Sizes — The helmets shall be of the sizes having circumference of inside headband as 480, 490, 500, 510, 520, 530, 540, 550, 560, 565, 570, 580, 590, 600, 610 and 670 mm. A tolerance of ± 3 mm for the size of the helmet shall be permitted.

4. Material

4.1 *Shell* — The shell of the helmet shall be made of a suitable hard, non-brittle, durable, non-metallic material, such as fibre glass, meeting the test requirements given in **8**.

4.2 *Protective Padding* — The protective padding shall be of rubber pads or expanded polystyrene, or styrene foam or materials of similar properties.

4.3 *Retention System* — The material for the headband, chin strap, anti-concussion tape and cradle shall be sweat-resistant and non-irritant and shall not cause any skin disease.

4.4 *Metal Parts* — The metal parts shall be of a corrosion-resistant material and shall not show any sign of corrosion when subjected to test as specified in Appendix A.

Adopted 20 December 1983 | | Gr 4

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5. Constructional Requirements

5.1 *Shell* — The shell shall have outer surface smoothly finished and shall not be specially reinforced at any point. The shape shall be essentially in the form of a continuous convex curve with no visible discontinuities in the rate of curvature. There shall be no external projections greater than 5 mm above the outer surface of the shell; where a goggle fitting is provided at the rear of the helmet, which is easily detachable, the requirement does not apply to this fitting. Any external projections other than press-fasteners shall be smooth and adequately faired. Rivet heads shall be radiused and shall not project more than 2 mm above the outer surface of the shell. There shall be no sharp edges on the inside of the helmet; rigid internal projections shall be covered with padding.

5.2 *Protective Padding* — A lining of protective padding shall be provided on the inner surface of the shell up to 5 ± 1 mm from the top edge of the corrugated sponge rubber padding (*see* **5.3.1**). The minimum thickness of the protective padding shall be 10 mm.

5.3 *Retention System*

5.3.1 *Headband* — The headband shall be not less than 30 mm in width and shall be fixed along with the corrugated padding to the shell. The headband shall be well cushioned from the shell by means of not less than 10 mm thick continuous corrugated sponge rubber fixed around the head.

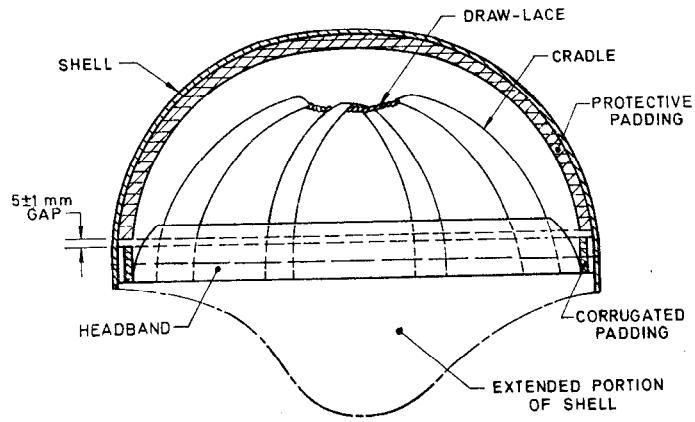


FIG. 1 A TYPICAL SKETCH SHOWING INTERNAL COMPONENTS OF HELMET FOR SCOOTER AND MOTORCYCLE RIDERS

5.3.2 *Chin strap* — The chin strap shall be anchored to the shell. It shall be at least 19 mm wide and shall be permanently fitted with a fastening device to adjust and maintain tension, which shall be free from any tendency to creep in use. The chin cup shall not be fitted to the chin strap.

5.3.3 *Cradle* — The cradle shall be formed by anchoring anti-concussion tapes at 8 points and shall be adjustable. The anti-concussion tapes shall be attached to the headband at equal spacing. The width of the tapes shall be not less than 20 mm. The cradle shall ensure a clearance of at least 30 mm between the top of the wearer's head and the inside shell when measured as given in **5.3.3.1**. No comfort padding shall be provided under the cradle.

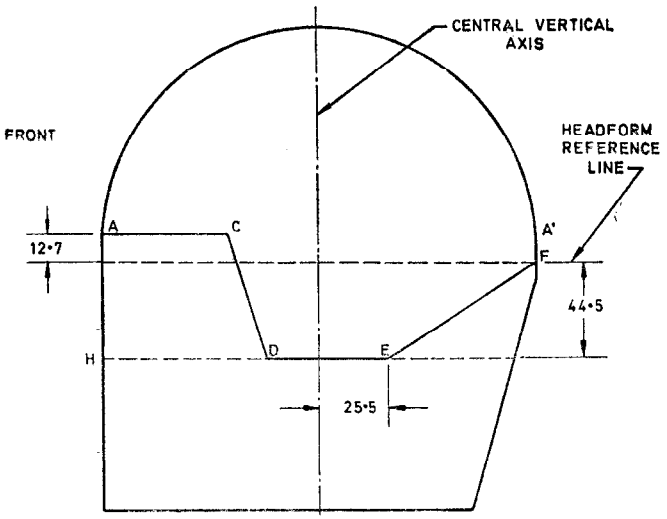
5.3.3.1 Mount the helmet on a headform (*see* IS : 7692-1975) corresponding to the size of the headband marked on the helmet, in a position similar to that which it would occupy on a wearer's head. Apply a load of 120 N to the top of the helmet. Measure the clearance by means of a rod having diameter not more than 10 mm, inserted through the hole drilled in the vertical axis of the headform.

5.4 *Peripheral Vision* — When the helmet is mounted on the appropriate head form (*see* IS : 7692-1975), the peripheral vision shall satisfy the following requirements:

a) An angle of vision of at least 105° measured horizontally to each side of the plane of symmetry drawn through reference line *AA* at a distance of 25, 26, 27, 28 and 29 mm on headforms 0, 1, 2, 3 and 4 respectively; and

b) An angle of vision of at least 33° above and 45° below the reference line measured vertically and parallel to the plane of the headform at and between two points equispaced 31 mm each side of the plane of symmetry mentioned in **5.4** (a) on the front side of the headform.

5.5 *Extent of Protection* — The extent of protection provided by the shell shall include all areas above circumference of a horizontal plane drawn at a height of 127 mm from the bottom of the headform. The shell shall extend downwards on both sides at least as far as the line *ACDEF* as marked on the headform (*see* Fig.2).



Headform Code Number	*AC*	*HD*
0	82	98
1	84	101
2	86	103
3	89	105
4	90	107

Note 1—The dimensions in the table are lengths of chords measured with the aid of deviders.

Note 2—Tolerance : ± 0·25 mm.

All dimensions in millimetres.

FIG. 2 EXTENT OF PROTECTION

5.5.1 To define the extent of the protection area, the standard headform shall be marked on each side with a base line and a line *ACDEF* corresponding to the extent of the minimum shell coverage.

5.5.2 The distance between the top of the headform and the top outside of the helmet shall not exceed 51 mm.

5.5.3 The protective padding material may be in one piece or made up from an assembly of segments arising from butting together of segments shall not exceed 6 mm in diameter or width. No part of the protective padding shall be readily detachable.

5.5.4 No peak shall be provided on the helmet.

6. Workmanship and Finish

6.1 All edges shall be rounded and smoothly finished and there shall not be any rigid projection inside the helmet. Any external projection permitted under **5.1** shall be soft, smooth and adequately faired into other surfaces.

6.2 If any metallic parts appear on the inside of the shell, they shall be covered by protective padding material and shall be of such a form that they cannot injure the wearer's head in the event of an accident.

7. Mass — The mass of the helmet shall not exceed 800 g.

8. Performance Tests

8.1 *Shock Absorption Test* — The helmets shall be tested for shock absorption by the method described in Appendix B within 1 minute after subjecting them to the conditions specified in (a), (b) or (c) below:

a) A temperature of 50 ± 5°C for 4 hours in an oven,

b) A temperature of −2 ± 1°C for 4 hours in a refrigerator, and

c) Water flowing over the whole outer surface of the shell at room temperature for 4 hours at a rate of 1 litre per minute.

No single helmet shall, however, be subjected to more than one of these conditions. None of the maximum values of transmitted force obtained separately at the front or at the back of the helmet shall exceed 20 kN. The shell shall remain intact with no cracks extending as far as the edge and through the thickness of the shell.

8.2 *Test for Resistance Penetration* — The helmets shall be tested for resistance to penetration in accordance with the method described in Appendix C within 1 minute after subjecting them to that of the conditions given in **8.1** which has given worst results in shock absorption. The point of the striker shall not contact the surface of the headform.

8.3 *Test for Strength of Retention System* — The helmets shall be tested for their retention system by the method described in Appendix D. The system shall not fail under the maximum load of 2 kN and the total extension as measured between the preload of 0·25 kN and the maximum load of 1 kN shall not exceed 25 mm.

8.4 *Rigidity Test* — The helmets shall be tested for rigidity by the method described in Appendix E. The maximum deformation shall not exceed the initial deformation by more than 40 mm and the residual permanent defermation shall not exceed 15 mm.

8.5 *Shock Absorption Test for Protective Padding Materials*

8.5.1 *General* — When two or more protective padding materials are used in a helmet, samples shall be tested by the method described in Appendix F. After subjecting one sample of each material to the hot and one to the cold test conditions, the samples shall comply with **8.5.2.**

8.5.2 *Two or more protective padding materials used above, or different materials used above and below, the base line* — The mean values of transmitted force shall be not greater than one and a half times that of the material or materials used at the test points described in Appendix B.

8.6 *Test for Flammability of Shell* — The material of the shell of the helmet, after completion of tests for shock absorption and resistance to penetration, shall be tested by the method described in Appendix G and shall not burn at a rate exceeding 50 mm per minute.

9. Scale of Sampling and Criteria for Conformity — The scale of sampling and criteria for confrmity shall be as given in Appendix H.

10. Instruction Card — Each helmet shall be supplied with a printed instruction card, fixed to it with a tag, giving the following instructions:

a) For adequate protection this helmet must fit closely and the drawlace must be knotted tightly enough to hold the helmet;

b) The chin strap must be under tension at all times of use;

c) This helmet is made to absorb some of the energy of a blow by partial destruction of its component parts, and even though damage may not be readily apparent, any helmet subjected to severe impact should be replaced; and

d) To maintain full efficiency of this helmet, there shall be no alteration to the structure of the helmet or its component parts.

11. Marking — Each helmet shall be clearly and indelibly marked with the following information on the inside of the shell:

a) Manufacturer's name or trade-mark,

b) Size, and

c) Year of manufacture.

11.1 *ISI Certification Marking* — Details available with the Indian Standards Institution.

12. Packing — Each helmet shall be packed in a box in accordance with the best prevailing market trend.

APPENDIX A

(Clause 4.4)

TEST FOR CORROSION RESISTANCE OF METAL PARTS

A-1. Samples

A-1.1 The samples shall be selected as given in **9.**

A-2. Procedure

A-2.1 — The specimens shall be sprayed with a solution of 5 parts of sodium chloride to 95 parts of distilled water (by mass) at room temperature (25 to 35°C) for a continuous period of 24 hours. They shall then be washed in clean running water, dried and inspected for signs of corrosion.

APPENDIX B

(Clauses 8.1 *and* 8.5.2)

SHOCK ABSORPTION TEST

B-1. Apparatus

B-1.1 *Wooden Headform* — Conforming to IS : 7692-1975.

B-1.2 *Gauge and Recording Apparatus for Measuring Force* — The gauge and the associated recording apparatus shall have a proper time-constant to be able to measure the impact loading up to 40 kN independent of the time of application of the force and a slow application of the load required for its calibration. The gauge shall have a minimum stiffness of 500 kN/mm. The headform shall be mounted on the gauge so that its inclined axis coincides with the vertical axis of the gauge.

B-1.2.1 *Accuracy* — The overall error of the whole set-up including the load measuring and recording system shall be not more than 10 percent.

B-1.3 *Concrete or Similar Monolithic Block* — Of minimum height, length and width 1 m, 1 m and 0·6 m respectively and mass 1t, to support the gauge and headform. The block shall be bedded on dry sand on a solid floor.

B-1.4 *Striker* — In the form of a rectangular block of wood of mass $5 \pm 0{\cdot}1$ kg and having a horizontal striking face 180 mm square. The striker shall slide freely and without oscillation down two vertical guide wires so positioned that the centre of gravity of the striker lies on the vertical axis of the gauge and both lie in the plane of the guide wires.

B-2. Method

B-2.1 The helmet shall be placed on the headform, front upwards. The striker shall be raised to a clear height of 2·5 m ± 5 mm above the point of contact with the helmet and allowed to fall freely. A photographic or other high speed record of the force transmitted during impact shall be made. The helmet shall then be reversed and the test repeated on the back of the helmet.

APPENDIX C

(*Clause* 8.2)

TEST FOR RESISTANCE TO PENETRATION

C-1. Apparatus

C-1.1 A test striker is allowed to fall freely onto the helmet securely fastened to a suitable headform. The contactable surface of the headform shall be of a metal that will readily permit detection should contact by the striker occur, and that can be restored after contact, if necessary.

The striker shall have the following characteristics:

Mass	3·00 ± 0·05 kg
Angle of point	60 ± 0·5°
Radius of point	0·5 ± 0·1 mm
Minimum height of cone	40 mm
Hardness of tip	45 to 50 *HRC*

C-2. Procedure

C-2.1 The helmet shall be securely fastened to the test headform or test block. This is effected by means of a bifurcated strap attached to the anchoring point on the base plate.

C-2.2 The striker shall be allowed to fall freely from a height of 2·5 m ± 5 mm, measured from the point of the striker, onto the top centre of the helmet.

APPENDIX D

(*Clause* 8.3)

TEST FOR STRENGTH OF RETENTION SYSTEM

D-1. Procedure

D-1.1 The helmet shall be placed on the appropriate headform with the chin strap fastened over a device approximating to the shape of the bony structure of the lower jaw. This shall consist of two metal rollers, 12·5 ± 0·5 mm in diameter and with centres 75·0 ± 0·5 mm apart. The helmet shall be supported on the headform so that the points of attachment of the chin strap to the shell are subjected to the same load as the strap itself.

D-1.2 After applying a preload of 0·25 kN for not less than 30 seconds an additional load of 0·75 kN shall be applied to the device retained by the chin strap at a uniform rate of 1 kN per minute. After 2 minutes at the maximum load the elongation of the retention system shall be by measuring the vertical distance between the reference points on the device and on the top of the helmet shell and comparing this distance with that obtained under preload.

APPENDIX E

(*Clause* 8.4)

RIGIDITY TEST

E-1. Apparatus

E-1.1 *Press with Two Parallel Metal Plates* — The plates shall be arranged so that the distance between them could be determined within ±1 mm.

E-2. Procedure

E-2.1 One helmet shall be tested along its longitudinal axis and the other along its transverse axis. In both cases the helmets shall be positioned between the two parallel plates by means of which the initial load of 30 N shall be applied to the helmet shell. After 2 minutes, the distance between the plates shall be measured. The load shall then be increased to 630 N by increment of 100 N every 2 minutes and maintained at that level for 2 minutes, after which the distance between the plates shall be measured again. The load applied to the plates shall then be reduced to 30N and maintained at this level for 5 minutes. The distance between the plates shall thereafter be measured once again. The difference in distance between the plates when the load was increased from 30 to 630 N and the difference in distance between the plates at the initial load of 30 N and the final load of 30 N shall be reported for both the longitudinal and transverse directions.

APPENDIX F

(*Clause* 8.5.1)

SHOCK ABSORPTION TEST FOR PROTECTIVE PADDING MATERTALS

F-1. Apparatus — Items specified in **B-1.2, B-1.3** and **B-1.4.**

F-2. *Method* — The first conditioned specimen of the material as used at one of the test points specified in Appendix B shall be placed on the top of the gauge for measuring force and shall be subjected to an impact so that the transmitted force is in the order of 19·60 kN. The two remaining specimens of the same sample shall also be subjected to a similar blow.

F-3. The three specimens of each of the other samples shall be subjected to a similar blow.

F-4. A record shall be made of the force transmitted during each impact. The mean of the transmitted forces for each sample shall be separately calculated for both the hot and the cold conditions and reported in kilonewtons.

APPENDIX G

(*Clause* 8.6)

TEST FOR FLAMMABILITY OF SHELL

G-1. A specimen approximately 12 mm x 127 mm shall be cut from the material of the shell in such manner that the strip is as flat as possible. Lines shall be drawn across the specimen at 13 mm intervals, measured along the 127 mm length, starting from one end. The other end shall be clamped in a rigid support so that the long axis of the specimen is horizontal. An alcohol lamp or gas burner, with the air supply cut off so as to give a flame 13-19 mm in height, shall then be placed under the free end of the specimen and adjusted so that the flame tip is just in contact with the material under test. It is important that a stop watch be started as soon as the flame is placed in contact with the specimen.

G-2. At the end of 10 seconds the flame shall be removed and the specimen allowed to burn. The rate of burning per minute shall be observed from the marked lines.

G-3. Three specimens shall be tested and the rate of burning calculated by averaging the results.

APPENDIX H

(*Clause* 9)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

H-1. Lot — In any consignment all the helmets of the same nominal size and of the same material, manufactured under similar conditions of manufacturing, shall be grouped together to constitute a lot.

H-2. Unless otherwise agreed to between the purchaser and the supplier, the number of helmets selected at random for subjecting them to the prescribed tests shall be in accordance with col 1 and 2 of Table 1.

H-3. All the helmets selected as above shall be examined for size (**3**), constructional requirements (**5**), workmanship and finish (**6**) and mass (**7**).

H-4. The lot shall be considered as conforming to the requirements mentioned in **H-3** only when the number of helmets failing to satisfy any one or more of these requirments does not exceed the corresponding number given in col 3 of Table 1.

H-5. A sub-sample of size given in col 4 of Table 1 shall be selected at random from those helmets which are found satisfactory with respect to the requirements mentioned in **H-3**. One-third of these helmets shall be subjected to test for rigidity (equal number for transverse and longitudinal directions (**8.4**). One-half shall be conditioned in accordance with **8.1** (a), (b) or (c), equal number being given one type of conditioning, and then subjected to test for shock absorption (**8.1**), and one-sixth for resistance to penetration (**8.2**). The sample used for resistance to penetration shall then be used for testing strength of retention system (**8.3**).

TABLE 1 SAMPLE AND SIZE CRITERIA FOR CONFORMITY

(*Clauses* H-2, H-4 *and* H-5)

Lot Size	Sample Size	Permissible No. of Defectives	Sub-Sample Size
(1)	(2)	(3)	(4)
Up to 100	8	0	6
101 to 150	13	0	6
151 to 300	20	1	6
301 to 500	32	2	6
501 to 1 000	50	3	12

H-6. One-half of the sample used for rigidity test shall be used to check corrosion of metal parts (**4.4**).

H-7. One helmet from the sample subjected to test for resistance to penetration shall be subjected to test for flammability of shell (**8.6**).

H-8. One-half of the sample used for rigidity test shall be used for shock absorption test for protective padding materials (**8.5**).

H-9. The lot shall be considered as conforming to the requirements of these tests if none of the helmets tested fails to satisfy the prescribed tests.

EXPLANATORY NOTE

While preparing this standard assistance has been derived from BS 4423 : 1969 'Specification for climbers' helmets', issued by the British Standards Institution (BSI).

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